DOCUMENT RESUME

ED 024 193 48 EC 003 159

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Michigan Univ., Ann Arbor. Center for Research on Language and Language Behavior.

Spons Agency- Office of Education (DHEW), Washington, D.C. Bureau of Research.

Bureau No- BR-6-1784

Pub Date [67]

Contract- OEC-3-6-061784-0508

Note- 21p.

EDRS Price MF-$0.25 HC-$1.15

Descriptors- Educable Mentally Handicapped, *Exceptional Child Research, *Language, Language Development, Language Tests, *Mentally Handicapped, *Motivation, Nominals, Positive Reinforcement, *Reinforcement, Structural Linguistics, Test Results

In a study of paradigmatic responding, 14 educable mentally retarded (EMR) boys from a training school were matched on chronological age (CA) and Stanford-Binet IQ scores. Six served as controls, six as experimental subjects, and two as training controls. They were pretested individually for a baseline measure of their paradigmatic responses to noun stimuli. The experimental group was trained to choose high paradigmatic associations following selective monetary reinforcement of their correct choices; all were posttested immediately following training and after a 1-week interval. Results indicated that the EMR's learned the training task regardless of CA. The reinforcement training procedure had a significant effect ($p<.05$) in rapidly increasing the paradigmatic performance on the word association task, and this frequency of paradigmatic responding transferred from the training list to the posttest as well as to words not occurring on the training list but used as free associative stimuli on the posttest. The change ($p<.05$) was still evident 1 week after training. It was concluded that the relatively low incidence of paradigmatic word association responses found in EMR children reflected performance variables rather than a developmental lag in language of EMR children. (Author/SN)

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Learning and Transfer of Paradigmatic Word Association by Educable Mentally Retarded Children: A Preliminary Report[1]

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This pilot study provided a baseline measure of paradigmatic responding of educable mentally retarded children and a measure of their ability to emit high associative paradigmatic responses following selective monetary reinforcement. 14 EMR boys from Wayne County Training School were individually pretested and a baseline measure of their paradigmatic responses to noun stimuli was obtained. The Ss were trained to choose high paradigmatic associations following selective reinforcement of their correct paradigmatic choices. The Ss were subsequently post-tested immediately following training and after a 1-week interval.

The results indicated that the Ss learned the training task regardless of CA. The reinforcement training procedure had a significant effect in rapidly increasing the paradigmatic performance of Ss on the word association task. The frequency of paradigmatic responding of EMR Ss in word association tasks transferred not only from the training list to the post-test in which the training was used, but also from the training list to the post-test in which words not occurring in the training list were used as free associative stimuli. This change was still evident 1 week after training. The relatively low incidence of paradigmatic word association responses found in EMR children (Semmel, Barritt, Bennett, & Perfetti, 1966) reflects performance variables rather than a developmental lag in the language of EMR children.

Several investigators (Brown & Berko, 1960; Erwin, 1961; Entwisle, Forsyth, & Muuse, 1964) have demonstrated a relationship between chronological age and grammatical form-class of free-associative responses in word association (W-A) tasks. These investigations found that children tend to move from sequential responses (Syntagmatic responses) to associations falling within the same grammatical form-class as the stimulus (Paradigmatic responses). The shift from syntagmatic to paradigmatic word associations is suggested as evidence for an increasing grammatical competence in language functioning (Brown & Berko, 1960).

Lenneberg (1964a, b; 1967) hypothesized a biological basis for language development. He asserts that language development may be relatively independent of "non-specific intelligence" and due to some "yet unknown species-specific biological capacities." One study (Semmel, Barritt, Bennett, & Perfetti, 1966) used a word association task to compare normal and educable retarded (EMR) children on paradigmatic and syntagmatic responses. The results demonstrated intellectual level to be a significant variable in determining the probability of paradigmatic associates. Retarded children revealed significantly fewer

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same form-class responses than did normal children of equal chronological age. Chronological age in normal children was validated as an important variable in determining the paradigmatic control of word associations.

The pilot study was designed to explore the effect of selective monetary reinforcement on the incidence of paradigmatic responding of EMR Ss in a controlled W-A task. It was predicted that retarded children would learn to emit paradigmatic responses in a multiple choice W-A task and that this learning would transfer to free W-A performance. The ability of retarded Ss to learn and transfer paradigmatic W-A responses would, in our view, support the argument that the absence of the "paradigmatic shift" in retarded Ss reflects language performance which is contingent upon environmental variables rather than an innate biological phenomenon related to the development of grammatical competence.

Method

Subjects. Table 1 presents the characteristics of the three subgroups used in this pilot study. Fourteen EMR boys from Wayne County Training School were selected for the study. The six control and six experimental Ss were matched for CA and Stanford-Binet IQ scores. The two training control Ss were also matched with two Ss from the experimental training group on these variables.

Insert Table 1 about here

Stimulus words. Twenty-five high frequency noun stimuli were selected from the Mein and O'Connor (1960) list of words most commonly used by retarded children. The 25 nouns were used as stimuli for a pre-test and post-test on a free W-A task (See Table 2).

Insert Table 2 about here

Nouns were selected as stimuli because Entwisle et al. (1964), Deese (1962), and Semmel et al. (1966) all found that younger children give a significantly greater number of paradigmatic responses to nouns when compared to other form-classes. Hence, it was reasoned that noun stimuli should have the highest probability of eliciting paradigmatic responses from EMR children.

Twenty high frequency nouns were selected for use as training stimuli (controlled W-A training list) from standard primer and pre-primer basal readers (New Basic Readers, Ginn Basic Readers, Dolch Basic Sight Vocabulary--see Table 2). The 20 nouns also appeared on the Jenkins & Palermo (J-P) Word-Association Norms (1963). Two lists were constructed using the 20-noun stimuli on both lists. For each noun stimulus in List I (Table 3), four words were selected from basal readers as alternative choice associative stimuli. Two of the four word choices were paradigmatic nouns and two syntagmatic adjectives selected according to the following criteria: one of the paradigmatic words was considered high-associative if it appeared on the J-P word list; the second paradigmatic word was considered low-associative if it did not appear on the J-P list. The same criteria were used in establishing high and low associative syntagmatic adjectives.

Insert Table 3 about here

List II (Table 4) was constructed in exactly the same manner as List I except that the two syntagmatic words were verbs, selected from basal readers.

Insert Table 4 about here

Procedure. The Ss were individually pre-tested on the 25 high frequency noun stimuli. The 25 W-A stimuli were randomized by hand-shuffling prior to presentation to the Ss. E said,

We are going to play some word games today. Now, if you are ready, I will tell you the rules for the game. In this game, I will read you a word from each of these cards. The idea of the game is for you to say the first word you think of when I say the word to you. You should say just one word and not more than one.

S was then presented two sample stimuli in order to test understanding of the task.

Coding procedures. The Ss' responses on the pre-test were recorded and served as baseline behavior of paradigmatic and syntagmatic W-A responses. When the response word could not be used sequentially with the stimulus word and was the same part of speech as the stimulus word, such as "dog" and "cat," the S was given credit for a paradigmatic response. Words which were not used

sequentially and were of different parts of speech, such as "girl" and "date"; words which followed each other sequentially and were of the same part of speech, such as "train" and "track"; and words which were used sequentially and were of different parts of speech, such as "baby" and "cries," were all placed in the syntagmatic category.

The judges were two graduate students in educational psychology. Inter-judge agreement was 100% on the coding procedure.

Experimental design. Four experimental Ss (S_1, S_2, S_3, and S_5) were given two pre-tests in the following order: the first pre-test consisted of the 25 W-A transfer stimuli as described previously; the second pre-test consisted of the 20 noun training stimuli used in the training task. This pre-test was administered immediately following the W-A transfer pre-test. The other two Ss (S_4 and S_6) were administered the W-A transfer pre-test only. The training procedure was introduced immediately following the pre-testing.

The instructions introducing the training task for each S were as follows: "Now we are going to play another word game. In this game you will have a chance to earn 50 cents. In this game you must read the first word I show you aloud." (E used a card to cover the four alternative choice stimuli while he introduced the noun stimulus.) "You are now to read the following four words aloud as I point to them." (The E read the word to S who was asked to repeat the word if he was unable to read it aloud.) "Pick the one word out of these four words which goes best with this word." (E again pointed to the noun stimulus.) "For each correct word you choose, I will give you a chip which you can exchange for money at the end of the game." The correct choice as determined by E was always the high-associative paradigmatic word (e.g., bread-butter). S was allowed to continue alternative words until the correct word was chosen. It was thus possible for S to make up to four selections for each noun stimulus.

The same procedure was employed for the remaining 19 noun stimuli. After completion of the first 20-word list, the same list was repeated three additional times. (Each new list was presented in a randomized order.) Thus, the procedure allowed each S a total of 80 trials on the experimental task. Three Ss (S_1, S_2, and S_4) were randomly selected and presented List I (noun-verb list) and the other 3 Ss (S_3, S_5, and S_6) were presented List II (noun-adjective), as the training task. Immediately after completion of the training task, Ss were again administered the transfer W-A and training lists as post-tests. Three Ss (S_1, S_4, and S_6) were presented with the 25 noun transfer word list followed by the

20 noun training word list. The three remaining Ss (S_2, S_3, and S_5) were presented with the same lists but in the reverse order.

One week later, all Ss except S_4 were again presented the two post-tests and in the identical order. (S_4 was not given the second post-test due to illness.)

Control groups. Six control (C) Ss were matched with experimental Ss on CA and IQ. These Cs received no training on the experimental task. Each C received the two pre-tests and, after a 30 min. interval, were administered the two post-tests. One week later, Cs again received the two post-tests. Two additional experimental control (EC) Ss were used in order to determine if the training stimuli would initially prime high associative paradigmatic responses previous to training. The procedure for these ECs was as follows: each EC received the two pre-tests and one week later they were presented with one of the training word lists of the training task. They were instructed to select the best word that went with the noun stimulus but were not reinforced or allowed to choose from the other three alternative words.

Preliminary Results

Pre-test results. Figures 1 and 2 present the mean percentage of paradigmatic responses on the 20-word training list used as a pre-test and on the 25-word association transfer test applied to the experimental and control group. The mean percentages of paradigmatic responses for the experimental and control groups on the 20-word training list were 65% and 64% respectively and on the 25-word transfer list 56% and 50% respectively. A t-test for matched samples was performed between the experimental and control groups on the two word association pre-tests. For both conditions, there was no significant difference between the number of paradigmatic associations (t_{20} = .40/df 3/p > .05; t_{25} = .56/df 5/p > .05).

Insert Figures 1 and 2 about here

Figures 3 and 4 present the individual paradigmatic scores of the experimental and control Ss on the 20-word training list used as a pre-test and on the 25-word association transfer test respectively. On the 20-word training test, the pre-test scores of the experimental Ss ranged from 35% (S_3) to 95% (S_1) and the scores of the control Ss ranged from 40% (C_6) to 90% (C_5). As

in Figure 4, the scores on the 25-word association transfer test for the experimental Ss ranged from 35% (S_4) to 68% (S_1, S_2, and S_5) and the scores of the control **Ss** ranged from 4% (C_3) to 88% (C_5).

Insert Figures 3 and 4 about here

Experimental S_1, S_2, and S_5 (from Figure 4) gave a significantly greater number of paradigmatic associations to the noun stimuli than did Experimental S_3, S_4, and S_6. (If the Ss emitted a percentage of paradigmatic responses greater than 65% on the pre-test, they were considered predominately paradigmatic responders.) In the control group, C_1, C_2, and C_5 gave a greater number of paradigmatic associations to the noun stimuli than did C_3 C_4 and C_6 who were predominately syntagmatic in their free associations.

Training results. All experimental Ss learned the training task rapidly. Figure 5 presents the cumulative number of choice responses on the training task for each experimental S. Although the maximum number of total choices on the 80 trials was 320, all Ss learned the tasks within 85 choice responses--based on the rather stringent criteria of 15 consecutively correct high associative paradigmatic responses. Each S learned the task within the following number of trials: S_1--45 trials, S_2--50 trials, S_3--45 trials, S_4--65 trials, S_5--70 trials, S_6--45 trials. A t-test for matched samples was used to compare rates of learning on the two training lists. There was no difference between the rate of learning on the noun-adjective and noun-verb lists ($t = .757/df\ 2/p > .05$).

Post-test 1 results. Figures 1 and 2 present the striking results of the post-tests for both the experimental and control groups. These figures indicate that on both the 20-word training list used as a post-test in this part of the experiment and on the 25-word transfer post-test, the experimental group showed a significant mean per cent difference from that of the control group. The mean per cent of paradigmatic responses for the experimental and control groups on the 20-word training post-test was 96% and 56% respectively; and on the 25-word transfer post-test the mean per cent responses was 65% and 47% respectively. A t-test for matched samples was performed between the experimental and control groups on difference scores for both the pre-test and the first post-test. For both word lists, there was a significant difference between the number of paradigmatic free associations on the pre-test and post-tests ($t_{20} = 2.64/df\ 3/p < .05$; $t_{25} = 2.63/df\ 5/p < .05$).

A t-test for within-group difference between means was performed on the 20-word training test and 25-word transfer pre-test and first post-test for both the experimental and control groups. For the experimental group there was a significant difference between the number of paradigmatic free associations (t_{20} = 12.81/df 3/p <.05; t_{25} = 2.29/df 5/p<.05). For the control group there was no significant difference between the number of paradigmatic free associations on the pre-test and post-test (t_{20} = 1.73/df 5/p>.05; t_{25} = 159/df 5/p>.05).

Figures 3 and 4 present the results of the first post-test of individual Ss on both the 20 training word list and 25-word transfer tests. As indicated in Figure 3, the percentage of paradigmatic responses of the experimental Ss ranged from 95% to 100% and of the control group from 15% (C_3) to 85% (C_5). It can be seen that all experimental Ss' test scores were sharply above the test scores of the control Ss.

On the 25-word transfer post-test, as indicated in Figure 4, the paradigmatic responses of the experimental Ss ranged from 28% (S_4) to 84% (S_2), Ss ranged from 4% (C_3) to 84% (C_5). Once again, the scores of the experimental Ss on the post-test were generally above those of the control Ss--except for one control S (C_5) who was a paradigmatic responder as evidenced from his pre-test scores.

An interesting finding concerned the experimental Ss' recall responses on the 20-word post-test. The group mean per cent recall on the post-test was 85%. It should be noted, however, that the Ss were not asked to recall the identical associations that were reinforced during the training. One week later the mean percentage recall for the group on the second post-test decreased to 51.1%.

Post-test 2 results. Figures 1 and 2 indicate that the experimental Ss' percentage of paradigmatic responses were significantly above those of the control group on the 25-word transfer association test (t_{25} = 2.01/df 4/p<.05). On the 20-word training list, no significant group mean percentages of paradigmatic responses were 87% on the 20 word training list used as a second post-test in this part of the experiment and 69% on the 25 word transfer association post-test. For the control group the mean percentages of paradigmatic responses were 56% and 38% on the respective tests.

A t-test for within-group difference between means was performed on the first and second post-tests of both groups. No significant difference was found for either group. Experimental within-group differences on both tests were t_{20} = 1.55/df f/p>.05 and t_{25} = .92/df 4/p>.05. The control within-group differences

on both tests were t_{20} = 0.0/df 5/p> .05 and t_{25} = 1.43/df 5/p >.05. As indicated in Figures 3 and 4, the paradigmatic responses for the experimental Ss ranged from 65% (S_5) to 100% (S_2) on the 20-word training post-test and from 48% (S_6) to 84% (S_2) on the 25-word transfer association post-test.

Finally, t-tests were computed on the within-group difference between the pre-test and the second post-test scores on the 25 word transfer association test. The results indicated a significant difference for the experimental group (t_{25} = 2.23/df 4/p< .05) and a nonsignificant difference for the control group (t_{25} = 1.67/df 5/p>.05). On the 20 word training post-test the results of both groups were nonsignificant. The experimental within-group difference was t_{20} = 2.02/df 3/p>.05 and the control group within-group difference was t_{20} = .84/df 5/p >.05.

The two additional EC Ss described in the procedure demonstrated that the 20-word training list did not initially elicit high associative paradigmatic responses. The Ss' results were consistent with their frequency of paradigmatic responses when the words were first introduced as a free association task. The scores of EC_1 on the 20-word training and 25-word transfer association tests were 10% and 20%; and for EC_2 were 30% and 28% respectively. The scores of EC_1 and EC_2 on the 20-word training list without reinforcement were 35% and 25% respectively.

Discussion

The preliminary results of this pilot study substantiate the hypothesis that reinforcing paradigmatic responses in EMR Ss on a multiple choice word association task enables the Ss to transfer paradigmatic responding to a free word association task. The ability of EMRs to learn and transfer paradigmatic word associations further supports the contention that the paradigmatic shift in W-A task may reflect an environmentally induced change in language performance rather than a biologically determined developmental phenomenon.

The results of the baseline data partially confirmed the findings of Semmel et al (1967) that institutionalized EMR children are not predominately paradigmatic responders on free word association tests. The consistent results of the control group in the present research indicates the relative stability of W-A performance. The consistency of paradigmatic responding was also noted in the frequency of these responses in a free word association task and the frequency of paradigmatic responses in a multiple choice word association task in the results of the two additional EC Ss. The data revealed considerable

individual differences in the baseline of W-A responses for Ss in the respective samples. No trends appeared to indicate the CA was correlated with the probability of Ss emitting paradigmatic responses. However, Ss with both higher CA's and MA's did tend to emit a higher rate of paradigmatic responding.

The results of the training procedure produced a relatively invariant and constant rate in learning high associative paradigmatic responses in which all experimental Ss learned the task. The two training lists, noun-verb and noun-adjective, did not significantly affect the experimental Ss' performance in choosing correctly the high associative paradigmatic word on the multiple choice W-A task. Since each trial contained a high association-syntagmatic choice word, the associative strength between the stimulus and S's response cannot account for the rapid learning of the high association paradigmatic choice. Hence, it is plausible to hypothesize that the EMR Ss learned to discriminate the abstract grammatical relationships between choice words. The rapid learning of correct responses suggests that Ss had the paradigmatic competence toward achieving an unpredicted rapid learning rate.

One of the most dramatic findings of this research was the significant change in paradigmatic responding among experimental Ss on the tests immediately following training. As predicted, the incidence of paradigmatic responding of EMR Ss in the word association task transferred not only from the training list to the post-test in which the training stimuli were used, but also from the training list to the post-test in which words not occurring in the training list were used as free-associative stimuli. The experimental group showed a significant within-group difference between the pre-test and the first post-test. There was also a significant between-group difference between the experimental group and the control group. We infer from these results that training for the experimental group was a significant variable in determining the frequency of paradigmatic responses to noun stimuli. The findings further demonstrated that the reinforcement procedure was effective in increasing the frequency of paradigmatic associations to noun stimuli irrespective of CA.

A frequent question that arises concerning experimental findings is whether significant effects are relatively permanent. The results of this study indicate that paradigmatic responses on the transfer test (second post-test) were still evident following a one-week interval. A significant difference was found between the experimental group and the control group on the second transfer post-test. A significant within-group difference was also found between

the results of the pre-test and the second transfer post-test in the experimental group after a one-week interval. Hence, we contend that the learning of paradigmatic performance which transferred to a free W-A test not only was evident immediately after training but was a relatively permanent effect.

In conclusion, EMR children cannot only be trained to increase the frequency of paradigmatic responses on a multiple choice word association task but can transfer this performance to a free word association task immediately after training, and maintain this performance after a one-week interval consequent to training. Therefore, the results imply that the relatively low incidence of paradigmatic word associations found in EMR children may not be indicative of an immutable lag in the development of the linguistic competence for making the "great step forward into syntactic operations" (Brown & Berko, 1960). Rather, we tentatively hypothesize that retarded children, like equal CA normal children, probably have the paradigmatic competence necessary for storage of linguistic units into grammatical form-classes. The difference appears to be that where normal children tend to "naturally" retrieve words having similar privileges of occurrence in an utterance frame, these habits are not as strong in EMR Ss and must be cued by relatively strong environmental stimuli.

Footnote

[1]The research reported herein was performed in part under Contract OEC-3-6-061784-0508 with the U.S. Department of Health, Education and Welfare, Office of Education, under the provisions of P.L. 83-531, Cooperative Research, and the provisions of Title VI, P.L. 85-864, as amended. This research report is one of several which have been submitted to the Office of Education as *Studies in language and language behavior, Progress Report V*, September 1, 1967.

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Figure Captions

Fig. 1. Mean percent of paradigmatic responses on the 20 word test for Ss in the two subgroups.

Fig. 2. Mean percent of paradigmatic responses on the free word association transfer test for Ss in the two subgroups.

Fig. 3. Performance of individual matched pairs on the 20 word training list.

Fig. 4. Performance of individual matched pairs on the 25 word transfer list.

Fig. 5. Total number of cumulative choice responses on the multiple choice list of 80 trials for the experimental Ss.

Table 1

Characteristics of EMR Subgroups

Control				Experimental			
Subjects	CA	MA	IQ	Subjects	CA	MA	IQ
C_1	184	108	63	S_1	187	135	75
C_2	181	123	72	S_2	183	114	66
C_3	162	105	68	S_3	158	99	66
C_4	160	104	68	S_4	153	91	63
C_5	153	103	70	S_5	136	98	73
C_6	130	86	67	S_6	126	75	60
Mean	161.67	104.83	68.00		157.16	102.00	67.17
SD	19.77	11.82	3.02		24.48	20.53	5.78
Range	130-184	86-108	63-72		126-187	75-135	60-75

Note: Two experimental control (EC) Ss were also used. EC_1 had CA = 162, MA = 103, and IQ = 67; EC_2 had CA = 128, MA = 76, and IQ = 60.

Table 2

Word Lists

Free W-A Transfer List (25 Noun Word List)	Training List (20 Noun Word List)
mother	dog
elephant	children
knife	girl
hand	kittens
boat	house
money	hand
fork	cars
bird	head
toy	lion
flower	man
horse	baby
milk	feet
apple	doors
ball	bread
ladder	chair
school	moon
water	city
coat	sheep
cow	bed
pictures	street
train	
snow	
t ree	
clock	
balloon	

Table 3

Noun-Adjective Training Stimuli

List I

GIRL	pretty	deep	boy	flag
MAN	floor	tall	wide	boy
LION	big	green	money	tiger
DOG	time	blue	cat	big
HAND	cow	soft	foot	sad
BREAD	hair	butter	good	low
CITY	brown	town	apple	big
DOORS	coat	windows	soft	wooden
HOUSE	home	deep	large	soap
HEAD	round	eyes	low	day
MOON	dry	hair	sun	yellow
CHILDREN	green	small	child	sky
KITTENS	rain	little	cat	rich
BED	bird	kind	soft	pillow
CHAIR	sky	sick	table	hard
BABY	day	child	small	wide
FEET	foot	room	rich	two
CARS	new	bus	left	duck
SHEEP	lamb	cake	hard	white
STREET	road	bag	dark	sweet

Table 4

Noun-Verb Training Stimuli

List II

DOG	cat	barks	reads	flag
HEAD	think	day	runs	eyes
BED	pillow	sleeps	bird	says
DOORS	got	coat	open	window
BREAD	hair	eats	butter	tells
FEET	gets	room	walks	foot
GIRL	must	boy	likes	flag
MOON	buys	sun	hair	shines
STREET	gives	road	bag	runs
CITY	apple	town	lives	asks
CARS	go	bus	duck	jumps
CHILDREN	child	sky	play	do
KITTENS	cats	lets	are	rain
HAND	foot	cow	jumps	gives
CHAIR	table	throws	sits	sky
HOUSE	lives	soap	says	home
BABY	reads	cries	child	day
SHEEP	jumps	sun	puts	lamb
MAN	boy	sees	floor	found
LION	roars	tiger	tells	money

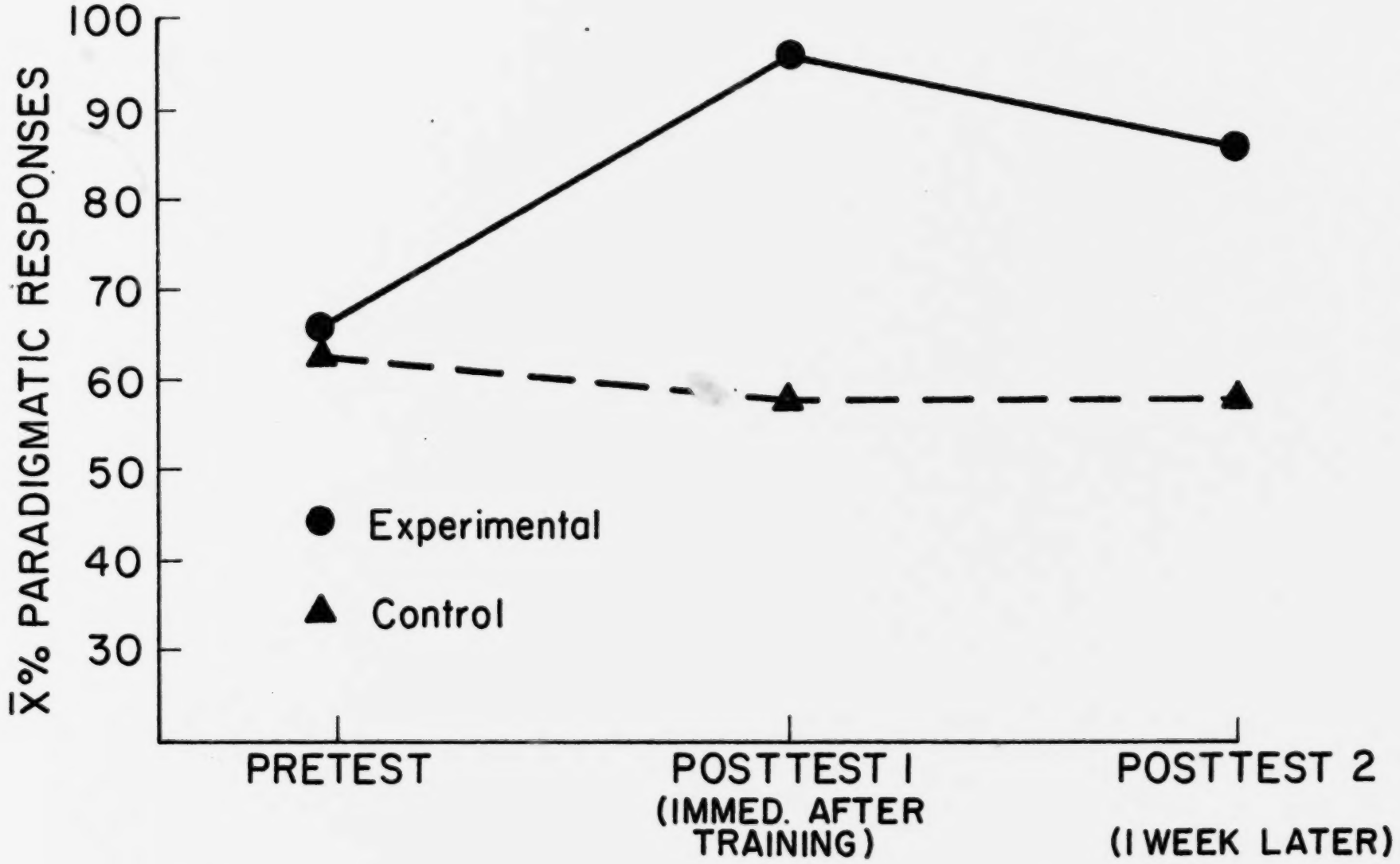

100
90
80
70
60
50
40
30
X̄% PARADIGMATIC RESPONSES
Experimental
Control
PRETEST
POSTTEST I
(IMMED. AFTER TRAINING)
POSTTEST 2
(I WEEK LATER)
TRAINING LIST ASSOCIATION DATA

Figure 1

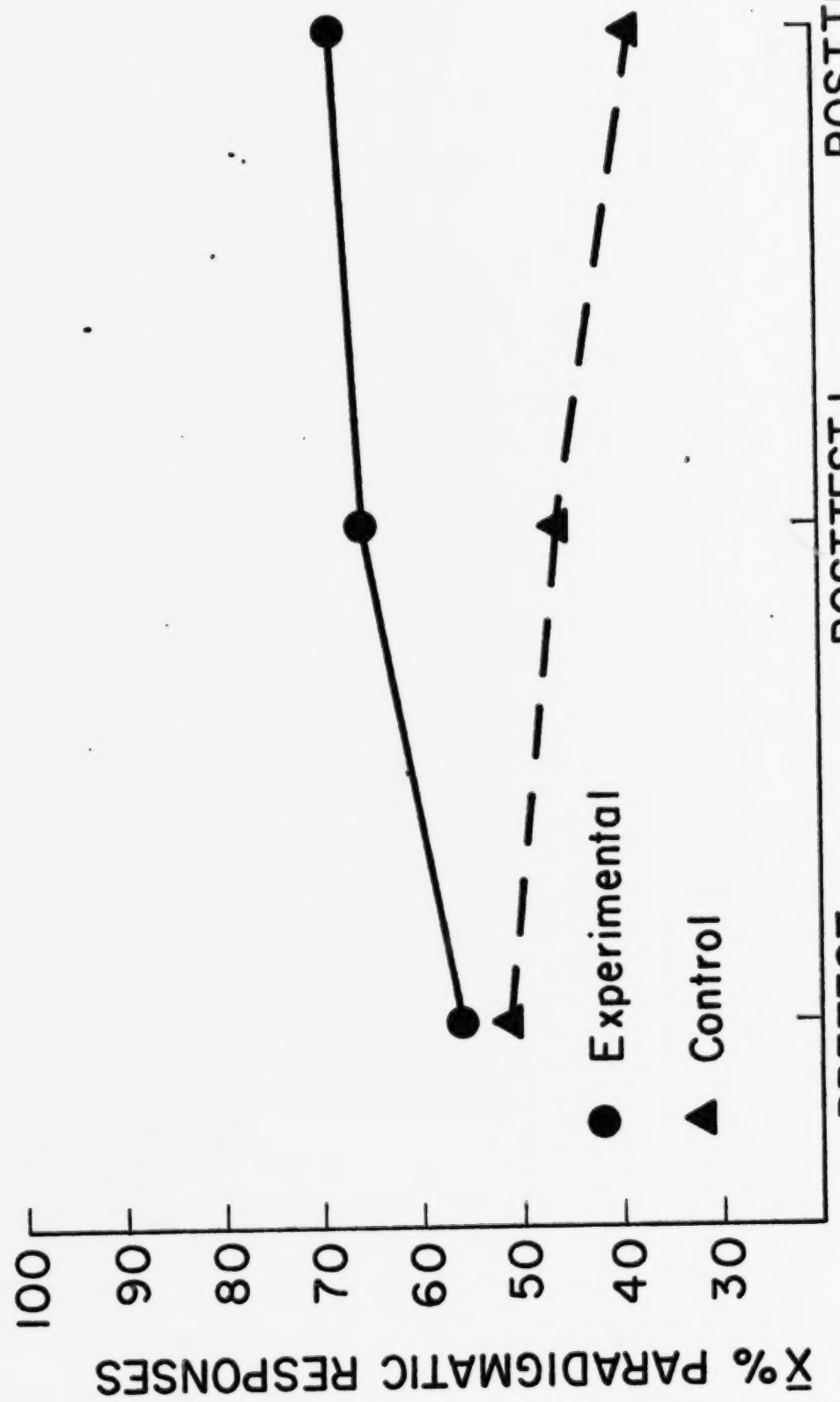
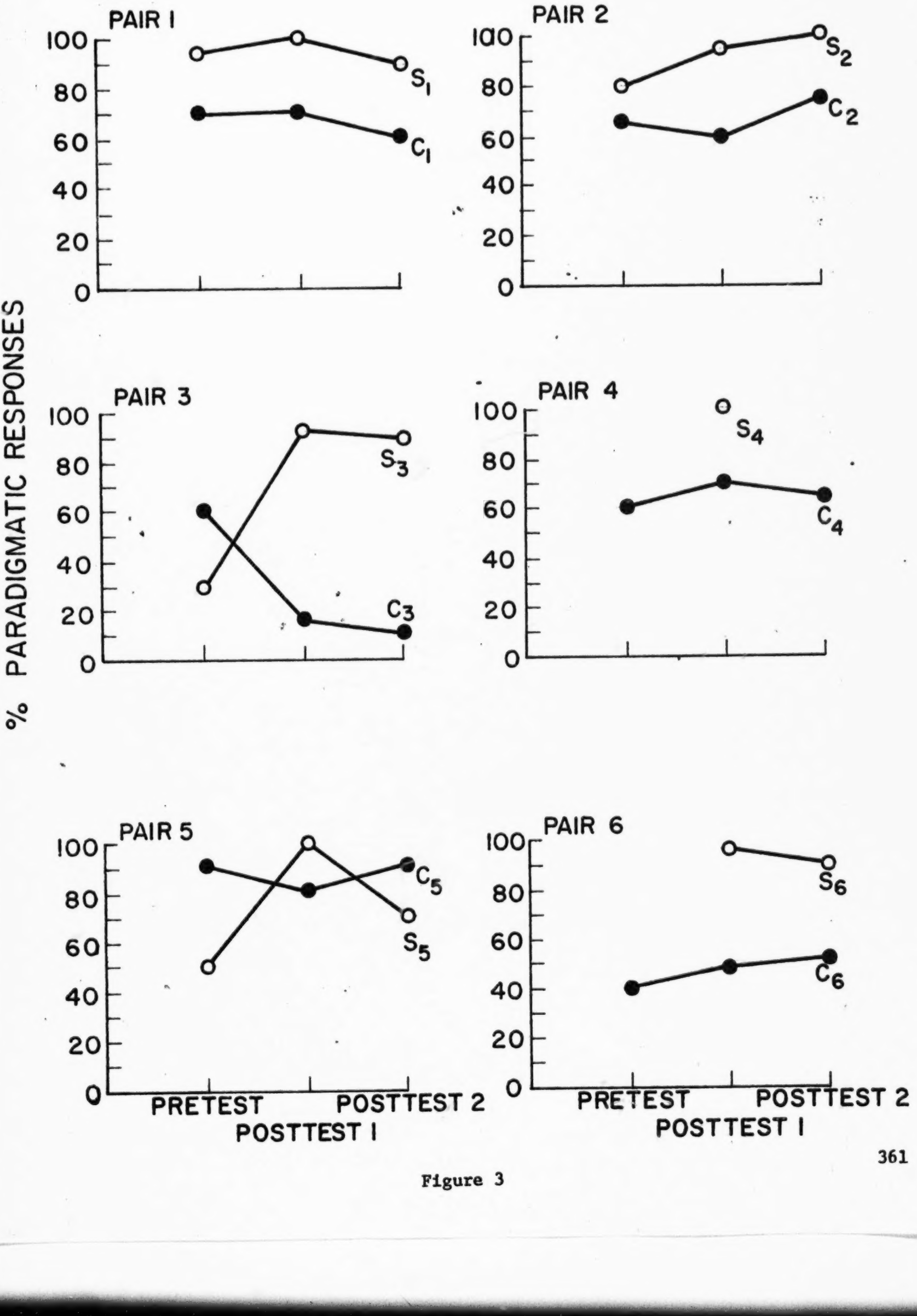

X̄% PARADIGMATIC RESPONSES
100
90
80
70
60
50
40
30
PRETEST
POSTTEST 1
(IMMED. AFTER
TRAINING)
POSTTEST 2
(1 WEEK LATER)
Experimental
Control
TRANSFER WORD ASSOCIATION DATA

Figure 2


PAIR 1
PAIR 2
PAIR 3
PAIR 4
PAIR 5
PAIR 6
% PARADIGMATIC RESPONSES
100
80
60
40
20
0
S1
C1
S2
C2
S3
C3
S4
C4
S5
C5
S6
C6
PRETEST
POSTTEST 1
POSTTEST 2

361

Figure 3

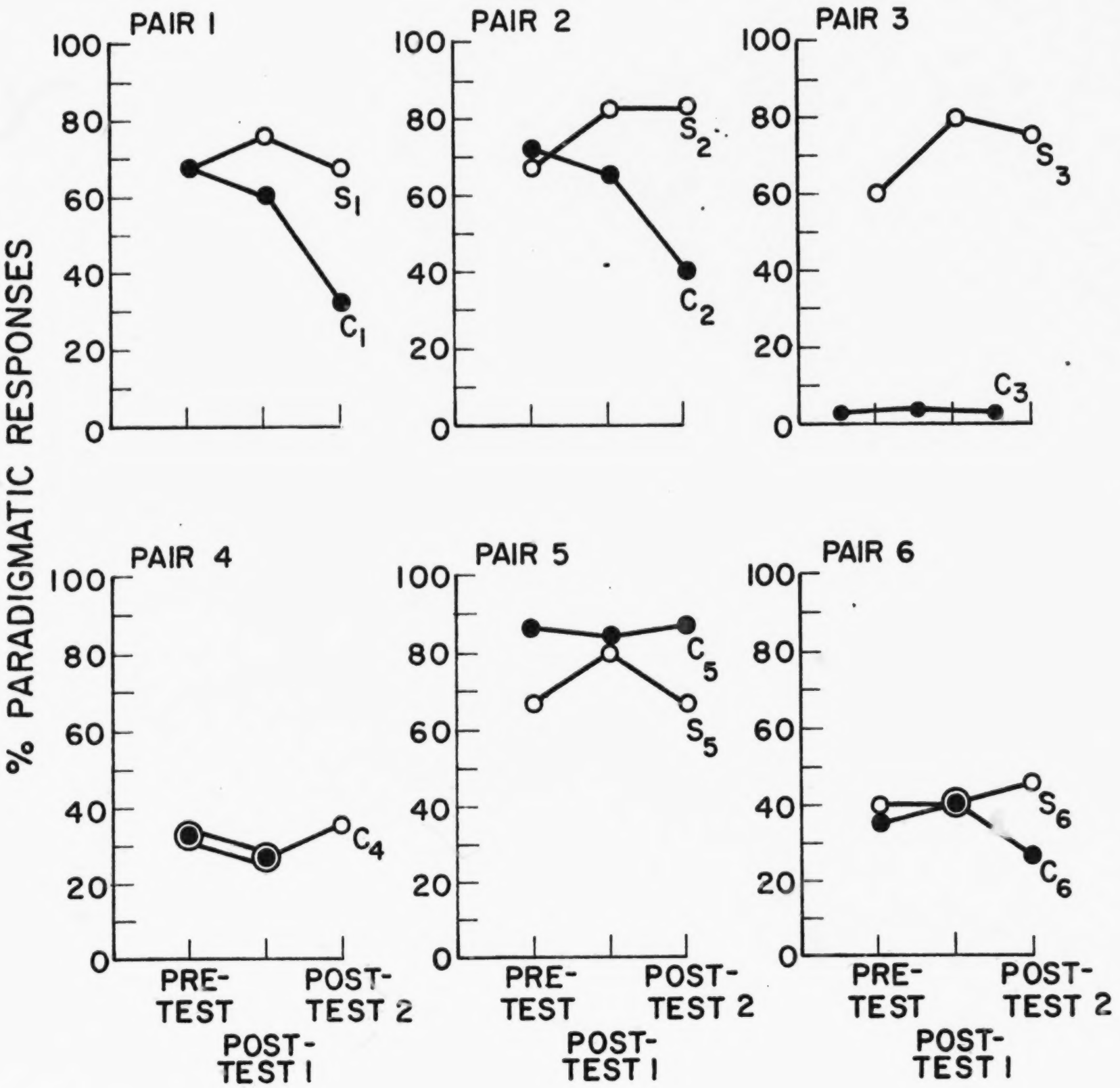

% PARADIGMATIC RESPONSES
PAIR 1
PAIR 2
PAIR 3
PAIR 4
PAIR 5
PAIR 6
100
80
60
40
20
0
S_1
C_1
S_2
C_2
S_3
C_3
C_4
C_5
S_5
S_6
C_6
PRE-TEST
POST-TEST 1
POST-TEST 2

Figure 4

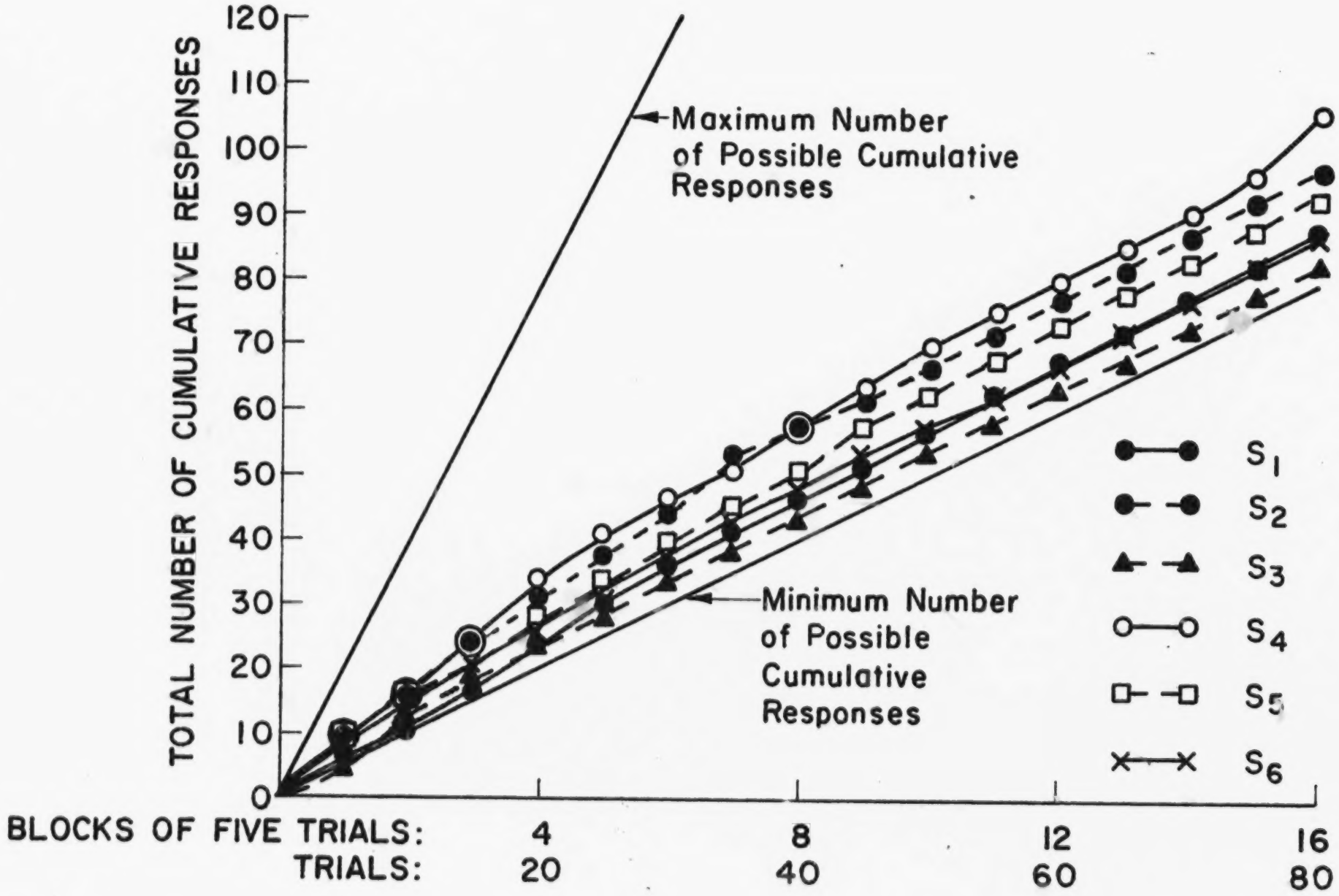

TOTAL NUMBER OF CUMULATIVE RESPONSES
120
110
100
90
80
70
60
50
40
30
20
10
0
Maximum Number of Possible Cumulative Responses
Minimum Number of Possible Cumulative Responses
S1
S2
S3
S4
S5
S6
BLOCKS OF FIVE TRIALS:
TRIALS:
4
20
8
40
12
60
16
80

Figure 5